



- 2.12 SPEAKERS
- 2.13 REVOLVING BEACONS
- 2.14 WATER FLOW ALARM DEVICES
  - 2.14.1 Pressure Switch
  - 2.14.2 Vane-Type Flow Switch
- 2.15 VALVE TAMPER SWITCHES
- 2.16 REMOTE AUXILIARY CONTROL RELAYS
- 2.17 POWER SOURCE
- 2.18 WIRING
  - 2.18.1 Fire Resistive Cables
- 2.19 SURGE SUPPRESSORS
  - 2.19.1 Line Voltage Surge Suppressors
  - 2.19.2 Low Voltage Surge Suppressors

### PART 3 EXECUTION

- 3.1 SYSTEM SEQUENCE OF OPERATION
  - 3.1.1 Normal Operation
  - 3.1.2 Supervisory Condition
  - 3.1.3 Trouble Condition
  - 3.1.4 Alarm Condition
- 3.2 INSTALLATION
  - 3.2.1 Fire Alarm Control Panel(s) and Reporting Equipment
  - 3.2.2 Addressable Modules and/or Devices
  - 3.2.3 Annunciator Panels
  - 3.2.4 Heat-Actuated Detectors
  - 3.2.5 Flame Detectors
  - 3.2.6 Smoke Detectors
  - 3.2.7 Manual Alarm Stations
  - 3.2.8 Alarm Bells/Speakers
  - 3.2.9 Strobe Units/Combination Audio Visual
  - 3.2.10 Auxiliary Control Relays
  - 3.2.11 Wiring
    - 3.2.11.1 60-Hertz Power
    - 3.2.11.2 Installation in Cabinets and Boxes
  - 3.2.12 Conduit and Raceways
  - 3.2.13 Elevators
- 3.3 FIELD TESTING
  - 3.3.1 External System Wiring
  - 3.3.2 Fire Alarm System Acceptance Tests
  - 3.3.3 Reacceptance System Tests
- 3.4 OPERATION AND MAINTENANCE MANUALS
- 3.5 PAINTING

-- End of Section Table of Contents --



circuit terminations on terminal strips in fire alarm control panels, terminal boxes.

Add to Section 01 11 00.00 98 SUMMARY OF WORK a description of the scope of the fire alarm work particular to this project.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

\*\*\*\*\*

## PART 1 GENERAL

### 1.1 REFERENCES

\*\*\*\*\*

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

\*\*\*\*\*

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME A17.1

(2007) Safety Code for Elevators and Escalators

FM GLOBAL (FM)

FM P7825 (2005) Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2008) Life Safety Code, 2006 Edition

NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

NFPA 72 (2006) National Fire Alarm Code

NFPA 75 (2008) Protection of Information Technology Equipment

NFPA 90A (2008) Standard for the Installation of Air Conditioning and Ventilating Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1016-2 (2003) Program Detail Manual Fire Alarm Systems, 8th Edition

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev B; Am 1) Colors Used in Government Procurement

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2006) Surge Protective Devices

UL 1480 (2003; Rev thru Dec 2006); Standard for Safety Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

UL 1971 (2002; Rev thru Oct 2008) Signaling Devices for the Hearing Impaired

UL 268 (2006) Standard for Smoke Detectors for Fire Alarm Signaling Systems

UL 268A (2008) Smoke Detectors for Duct Application

UL 346 (2005) Waterflow Indicators for Fire Protective Signaling Systems

UL 38 (2008; Rev thru Dec 2008) Standard for Signaling Boxes for Fire Alarm Systems

UL 464 (2003; Rev thru Feb 2008) Standard for

## Audible Signal Appliances

UL 497B	(2004; Rev thru Oct 2008) Protectors for Data Communication and Fire Alarm Circuits
UL 521	(1999; Rev thru Jul 2005) Heat Detectors for Fire Protective Signaling Systems
UL 1711	(1994) UL Standard for Amplifiers for Fire Protective Signaling Systems, 3rd Edition
UL 2196	(2001) UL Standard for Tests for Fire Resistive Cables, 1st Edition
UL Fire Prot Dir	(2008) Fire Protection Equipment Directory

## 1.2 SUBMITTALS

\*\*\*\*\*

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

\*\*\*\*\*

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Submit Evidence of the Contractor's State Certification to the Contracting Officer for approval, prior to any work being started on the Fire Alarm System.

Submit fully verified and dated copies of all Fire Alarm Acceptance test data and results with a copy of the approved test procedure and any factory test information.

Provide one copy of the test procedures and recording forms for the preliminary tests. For the final acceptance tests, provide 10 copies of the test procedures and recording forms.

#### SD-02 Shop Drawings

Submit the following in accordance with the paragraph entitled, "General Requirements".

- Connection Drawings
- Schematics
- Module Schematic Drawings
- As-Built Drawings
- Revised Programs
- Fire Alarm System Acceptance Tests
- Fire Service Floor Plans

#### SD-03 Product Data

Submit Manufacturer's Catalog Data for the following items:

- Fire Alarm Control Panel
- CFMS Reporting Equipment
- Addressable Modules/Devices
- Annunciator Panels
- Heat-Actuated Detectors
- Flame Detectors
- Smoke Detectors
- Duct Smoke Detectors
- Manual Alarm Stations
- Alarm Bells
- Strobe Units
- Speakers
- Fire Resistive Cables
- Revolving Beacons
- Water Flow Alarm Devices
- Valve Tamper Switches
- Remote Auxiliary Control Relays
- Power Source
- Line Voltage Surge Suppressors
- Low Voltage Surge Suppressors
- Wiring

\*\*\*\*\*  
NOTE: Coordinate these submittals with Contract  
Schedule Section IV, "Inspection Testing  
Requirements".  
\*\*\*\*\*

## SD-05 Design Data

Design Analysis and Calculations  
Voice Evacuation System  
UV/IR Detectors

Submit list of parts and components in accordance with the paragraph entitled, "General Requirements," of this section.

## SD-07 Certificates

Submit [Quality Assurance Plan](#) consisting of the following in accordance with the paragraph entitled, "Quality Assurance" of this section.

Submit proof that all components are Underwriter Laboratory (UL) [UL Fire Prot Dir](#) listed or Factory Mutual (FM) [FM P7825](#) approved for their intended use and function.

## SD-10 Operation and Maintenance Data

Submit [Operation and Maintenance Manuals](#) in accordance with the paragraph entitled, "Execution" of this section.

### 1.3 GENERAL REQUIREMENTS

Section [26 05 00.00 40](#) COMMON WORK RESULTS FOR ELECTRICAL and Section [26 00 00.00 20](#) BASIC ELECTRICAL MATERIALS AND METHODS apply to work specified in this section.

Submit [Connection drawings](#) for approval [60] [90] [120] days prior to installation of the Fire Alarm and Detection System(s). Connection drawings must consist of point-to-point wiring diagrams of internal and external wiring including, but not limited to, all fire alarm field devices, panel wiring, and interconnection between other building systems and components.

Submit .DXF or .DWG format computer generated connection drawings, schematics, As-Built drawings and Fire Service Floor Plans.

Submit [Schematics](#) for approval for Fire Alarm and Detection Systems consisting of the following:

[Module schematic drawings](#) (minimum size [216 by 280 millimeter](#) [8-1/2 by 11 inches](#) to be provided prior to system acceptance testing.

Submit [As-Built drawings](#) indicating all field changes for approval twenty one (21) days prior to the acceptance testing phase of the project as described in the paragraph entitled, "Field Testing" of this specification section. Provide magnetic media and hard copies of all new and revised software and drawings with the submittal. As-Built drawings must document final system configuration including, but not limited to geographic monitor zone boundaries, location of the fire alarm control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, wet and dry pipe sprinkler risers, dry pipe control panel, smoke and fire dampers, magnetic door holders, and all other equipment associated with the fire alarm system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used), deviations from and amendments to the as-built drawings, and



field installation changes, concealed and visible.

**Revised programs** information, both hard copy and discs, for existing Simplex or Siemens Central Fire Monitoring System. Program information for fire alarm control panel including program listings, system point summary, and addressable device switch settings must be submitted for approval twenty-one (21) days prior to the acceptance testing phase of the project, as described in the paragraph entitled, "Field Testing" of this specification section.

Program logic and/or sequence of operations which clearly shows the interaction of system components.

Conduct **Fire Alarm System Acceptance Tests** in accordance with the paragraph entitled, "Field Testing" of this specification. Prepare a test procedure and test record form for conducting complete tests on control panels, reporting systems, wiring systems, and field devices installed in accordance with the manufacturer's requirements and these specifications. Submit for approval the test procedure to the Contracting Officer at least thirty (30) days prior to the preliminary system test described in the paragraph entitled, "Field Testing" of this specification section. Test procedure must identify each device and circuit to be tested, describe the initial condition, each step or function in the test, required test result, and equipment to be employed. Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. Test record forms also have identified spaces for verification signatures of official witnesses and dates of the test.

**Fire Service Floor Plans** must indicate location of the fire alarm control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, detection systems, wet and dry pipe sprinkler risers, dry pipe control panel smoke and fire dampers, magnetic door holders and all other equipment associated with the fire alarm system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used). There must be no borders or title blocks on the Fire Service Floor Plan. Provide a symbol legend, which clearly identifies each device shown on the Fire Service Floor Plan. Install a copy of the Fire Service Floor Plan, minimum size **457 millimeter x 610 millimeter 18 x 24 inches** in a painted metal frame with a plexiglass cover. The floor plan and it's location must be submitted for approval to the Contracting Officer, prior to installation.

**Design Analysis and Calculations** must be submitted for approval for the Fire-Alarm and Detection Systems consisting of the battery capacity and loading calculations in accordance with the paragraphs entitled, "Fire Alarm Control Panel", "Voice Evacuation System: and **"UV/IR Detectors."**

Submit list of parts and components in accordance with the paragraph entitled, "SYSTEM REQUIREMENTS" of this section.

#### 1.4 SYSTEM REQUIREMENTS

Fire-alarm system must be a fully addressable, modular type, microprocessor based, supervised, non-coded electrical fire alarm system with **NFPA 72** Style D initiating device circuits, **NFPA 72** Style Z notification appliance circuits and **NFPA 72** Style 7 signaling line circuits. All styles of Class A initiating device, signaling line, notification appliance and control circuits must use diverse routing in accordance with **NFPA 72**. The outgoing and return redundant circuit conductors must not be run in the same cable

assembly, enclosure or raceway. System must be electrically connected to report alarms, silent alarms, troubles, and supervisory signals to the Central Fire Monitoring System; sound the general alarm continuously; and control auxiliary equipment such as dampers, air handling units, magnetic door latches, elevator recall, etc., upon operation of one or more initiating devices. Initiating, notification, signal, and auxiliary control circuits must be 24 V(DC).

System must conform to all the applicable requirements of NFPA 70, NFPA 72, NFPA 75, NFPA 90A, and NFPA 101.

Fire alarm systems must contain all of the equipment, devices, programming and circuits required for system operation in accordance with NFPA Codes and KSC requirements, including remote reporting to and remote control from existing, [Simplex] [Siemens] based equipment.

Provide all additional equipment, cabinets, conduit, and labor to meet the requirements and intent of this specification.

Provide a list of parts and components for the installed system by manufacturer's name, part number, and nomenclature, and recommended stock level required for normal maintenance and unscheduled repairs.

Components installed under this contract can not be more than one (1) year older than the date of installation.

#### 1.5 QUALITY ASSURANCE PLAN

Equipment to be provided under this specification must be that manufactured fire-alarm equipment which meets the requirements of the section entitled, "System Requirements." It must be the latest standard design, and must be listed by Underwriters' Laboratories or approved by Factory Mutual and be suitable for its intended service. All devices installed must function with the control panel and not interfere with the operation of the control panel.

#### 1.6 SERVICES OF A CERTIFIED FIRE ALARM SPECIALIST

Services of a Certified Specialist thoroughly experienced in fire detection and alarm work must be provided on site to perform or directly supervise the installation, make all necessary adjustments, make all adjustment and perform all tests on the fire alarm system at the site.

Fire Alarm specialist is considered certified when the specialist holds a valid Fire Alarm System, Level III Certification from the National Institute for Certification in Engineering Technologies NICET 1016-2 or a valid Level III Fire Alarm Engineering Technician Certification from the International Municipal Signal Association (IMSA) or is licensed by the State of Florida as a Fire Alarm Contractor I in accordance with Florida State Statute, Chapter 489, Part II.

Certification of other recognized agencies with equivalent requirements will be considered. Evidence of the Contractor's State Certification and the basis of certification must be provided to the Contracting Officer and be approved by the Contracting Officer prior to any work being performed at Kennedy Space Center.

## PART 2 PRODUCTS

### 2.1 FIRE ALARM CONTROL PANEL

Fire alarm control panel (FACP) must contain power-on, alarm, supervisory, and trouble indicating lights plainly visible when the cabinet is closed. It must also contain the following functions and must be accessible only by unlocking and opening the unit:

- Alarm Silence
- Trouble Silence
- Supervisory Silence
- Power On-Off (If standard by the manufacturer)
- Alarm/Trouble Acknowledge
- Auxiliary Devices (AHU shutdown relay) Maintenance By-pass
- Switches
- System Reset

Fire alarm control panel must contain all components necessary to monitor and supervise all initiating device circuits. When any detector, manual alarm station (pull box), water flow switch, pressure switch, etc., connected to the fire alarm control panel is activated, the control panels visual alarm, alarm indicator and audible signal must be activated. This must cause all notification appliances to be activated, including all associated auxiliary control functions. The control panel must visually indicate the addressable device or zone in alarm and transmit an alarm condition to the remote Central Fire Monitoring System. Separate audible and visual notification appliance circuits. Audible and visual notification appliance circuits must have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity. Visual notification appliances must remain operational until the FACP has been reset.

Fire alarm control panel must contain all components necessary to monitor and supervise all supervisory device circuits. When any valve tamper switch, low air pressure switch, water level indicator, or other supervisory device connected to the control panel is activated, the control panel supervisory visual indication and supervisory audible device must be activated. The control panel must visually indicate the addressable device or zone in supervisory alarm and transmit a supervisory condition to the remote Central Fire Monitoring System.

Fire alarm control panel must contain all components necessary to operate and supervise the circuits for annunciator panels indicated and auxiliary devices controlling equipment such as ventilating fans, air handling units, fan coil units, damper motors, solenoids, magnetic door holders, elevator recall, etc. Circuits for auxiliary control relays must be supervised to within 3-feet of the device to be controlled in accordance with [NFPA 101](#). Fire alarm control panel must include maintenance by-pass switches for all auxiliary control devices. By-pass switches must be supervised to report trouble when in the maintenance (by-pass) position.

Panel must monitor and report as trouble, open supervised circuits, ground faulted supervised circuits, removal of detector or device, removal or failure of control panel module, maintenance by-pass switch activated, loss of primary power, power supply trouble, low battery voltage, loss of battery voltage, [fire alarm control panel enclosure open,] and activation of the alarm silence switch. All trouble signals must be identified by initiating, notification appliance, auxiliary control, or signaling line

circuit. Trouble signals must activate the control panel trouble visual indication and trouble audible devices, and send a trouble signal to the remote Central Fire Monitoring System.

Alarm and trouble reset switches must reset a cleared device in alarm or trouble. Alarm or trouble signals must not be self-restoring without activating the switch.

Alarm, supervisory, and trouble silence switches must silence the alarm, supervisory, and trouble audibles. Either switch placed in other than the normal position must provide the following:

- a. Report as an alarm, supervisory, or a trouble to the Central Fire Monitoring System.
- b. Transfer audible signal to a panel lamp visual indication.
- c. Re-ring the trouble audible if the problem has been cleared, but the switch has been left in the silence position.

When the alarm silencing switches are in the silence position, subsequent alarms must reactivate the notification appliance. The strobes must remain operational until the fire alarm control panel is reset.

Fire alarm control panel must be suitable for use with the detectors and manual alarm stations and other fire alarm devices specified in this section.

Fire alarm control panel must have a normally closed set of dry contacts single pole, double throw (SPDT), which opens for trouble conditions and a normally open set of dry contacts single pole, double throw (SPDT), which closes under alarm conditions for connection to the Central Fire Monitoring System.

All relays must be continuous duty and have self-cleaning contacts of silver or an alloy of equivalent performance. Supervisory relays must be suitably protected against dust by individual covers. All relays that provide external functions, such as remote reporting, control device activation, and notification appliance activation must have at least one set of spare contacts. Permanently mark relays with the coil resistance, operating-current range, and internal pin connections using standard pin numbers.

[Install a separate terminal cabinet adjacent to the fire alarm control panel for interfacing device field wiring to the control panel. Install terminal strips for all field wiring circuits plus 25 percent spare. Where a terminal cabinet is installed, install terminal strips to accommodate remote reporting circuits.]

Fire alarm control panel, terminal cabinets, surge suppression cabinets and battery cabinets (when used) must be steel, provided with a hinged cover and an integral pin-tumbler cylinder lock (Lock Cylinder No. Best Universal Lock Co. No. A8817-XUS26D-7KSC) with removable core that accepts the key presently in use with other control units existing in the area; lock core will be provided by the government. Cabinets must be painted with a prime coat and one or more finish coats of scratch-resistant baked enamel. Finish coat must be red unless otherwise indicated.

Fire alarm control panel must include all components and modules required

for a local facility maintenance and fire fighters phone system. Install a master telephone set at the control panel with remote phone jacks installed in the facility as indicated on the contract drawings, expandable to [6] [\_\_\_\_\_] separate Style B supervised telephone circuits. Telephone control must include switching with visual indication for phone circuit activate.

Fire alarm control panels **voice evacuation system** must include all components and modules required for a [single] [multiple] channel audio signaling system distributed over [8] [\_\_\_\_\_] audio signaling device circuits. Audio system must be capable of accurately reproducing bell tones and pre-programmed voice messages for [staged] building evacuation. Audio amplifier input must include a dedicated power supply with a primary power input of 120 V(AC) and a battery backup input of 24 V(DC). Audio amplifier output must be a minimum of 100 watts at 24 VRMS, with a minimum of 25 percent spare capacity provided. Locate a microphone and **102 millimeter 4 inch** speaker at the control panel for fire fighter paging and monitoring. Audio system control must include switching with visual indication for localized facility-wide paging announcements. Messages must be multi-lingual voice in five (5) languages, followed by temporal three (3) bell tone until silenced. The languages in priority are English, Spanish, French, Japanese, and Russian. The languages must be approved by the Contracting Officer.

System must operate from a power supply with 120 grounded V(AC) input and 24 V(DC) output. System must operate satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Power supply output must be capable of powering all initiation, signaling, annunciation, and control devices during alarm condition with 25 percent minimum spare capacity. [If supplied within the cabinet, the power on-off switch must disconnect all power sources to the control panel. The on-off switch must have DC rated contacts.]

Batteries, charger, and power transfer equipment must provide the means of automatically supplying the entire fire alarm system with battery backup power in event of a primary power system failure. System must switch to battery power in event of AC power failure and switch back to AC power upon return of primary power. Control panel must be able to operate when the backup batteries are disconnected for any reason. System must control charging currents and floating voltage levels to maintain batteries in optimum condition. Provide capability to recharge batteries in event of discharge. Wiring must be fused to protect against battery over-current and polarity reversal. Primary power, battery, or charging equipment failure must result in a fire alarm control panel trouble signal and visual indication.

Battery modules must be sealed (no corrosive fumes) and spill-proof. Batteries must be listed for fire alarm service and must be suitable for high discharge currents required under alarm conditions. Batteries must be sized to operate the fire alarm and detection system (including voice evacuation system and UV/IR flame detectors) in normal supervisory condition for 24 [48] [72] hours, minimum, then operate the system in the alarm mode for [5] 10 [15] [\_\_\_\_\_] minutes, minimum.

#### 2.1.1 Small Capacity FACP

\*\*\*\*\*

**NOTE: Edit the following paragraph for a fire alarm control panel to be used in small facilities or suppression systems. Each automatic sprinkler system flow switch must report as a separate device**

to the FACP. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of circuits anticipated.

\*\*\*\*\*

Unit must be a Siemens Model [ ] or Simplex Model [\_\_\_\_], comprised of [12] [\_\_\_\_] or less active monitor zones, [2] [\_\_\_\_] notification appliance circuits, [4] [\_\_\_\_] supervised circuits to remote auxiliary control relays, and [2] [\_\_\_\_] local auxiliary relay circuits. Unit must be expandable to 32 monitor zones and 6 notification appliance circuits. Construction must be modular, solid-state microprocessor based electronics. All modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements.

#### 2.1.1.2 Siemens Medium Capacity FACP (Without Voice)

\*\*\*\*\*

**NOTE:** Edit the following paragraph for a fire alarm control panel to be used in facilities which do not require voice evacuation systems. Fill in the blanks to fulfill the job requirements and the maximum number of zones anticipated.

\*\*\*\*\*

[Unit must be a Siemens MXL-IQ with greater than [\_\_\_\_] active monitor zones, minimum [\_\_\_\_] notification appliance circuits, minimum [\_\_\_\_] supervised circuits to remote auxiliary control relays, and minimum [\_\_\_\_] local auxiliary relay circuits. Unit must be expandable to 3000 [240] addressable devices. Construction must be modular with solid-state, microprocessor based electronics. Modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Fire alarm control panel(s) (FACP) must include all hardware required for Style 7 communication with the existing Siemens NCC WAN system located at the XY Building. Reporting circuit must be a 4 wire, Style 7 circuit from the Siemens NCC WAN system to the fire alarm control panel, via the base outside cable plant. The color graphics units (CGU) are located in facility 49750 (Alternate Central Security Building) and a redundant CGU is located in Building 1708 (Hangar R&D). The Siemens programmer must ensure that all information required by the contract drawings and specifications are transmitted and received at both locations, and that all color graphics screens operate properly. Bi-directional communication between the FACP and the NCC WAN must permit individual remote reporting of all monitor zones and remote control of the FACP from both CGU locations.]

Fire alarm control panel must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the fire alarm control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

#### 2.1.1.2.1 Simplex Medium Capacity Fire Alarm Control Panel (Without Voice)

Unit must be a fully addressable system, Simplex Model [\_\_\_\_], comprised of [\_\_\_\_] addressable devices, [2] [\_\_\_\_] notification appliance circuits, and [4] [\_\_\_\_] supervised circuits for auxiliary control relays. Unit must be expandable to 12 notification appliance circuits. Construction must be modular, solid-state microprocessor based

electronics. All modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Panel must include modules required for communication interface with the existing Simplex based Central Fire Monitoring System, including Style 7 module for operation of redundant remote reporting circuits. [Communication interface must permit individual remote reporting of all monitor zones and remote control of the fire alarm control panel outputs from the Central Fire Monitoring System.]

Fire alarm control panel must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the fire alarm control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

\*\*\*\*\*

**NOTE: Select and edit the following paragraphs for a Simplex, or Siemens fire alarm control panel to be used in a large size facility or facility requiring addressable devices, voice evacuation, or fire fighters telephone.**

\*\*\*\*\*

#### 2.1.3 Siemens Large Capacity Fire Alarm Control Panel (With Voice)

Unit must be a Siemens [MXL] or [Fire finder] with greater than [\_\_\_\_\_] active monitor zones, minimum [\_\_\_\_\_] notification appliance circuits, minimum [\_\_\_\_\_] supervised circuits to remote auxiliary control relays, and minimum [\_\_\_\_\_] local auxiliary relay circuits. Unit must be expandable to 3000 [\_\_\_\_\_] [240] [\_\_\_\_\_] addressable devices. Unit must be expandable to 3000 [240] addressable devices. Construction must be modular with solid-state, microprocessor based electronics. Modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Fire alarm control panel(s) (FACP) must include all hardware required for Style 7 communication with the existing Siemens NCC WAN system located at the XY Building. Reporting circuit must be a 4 wire, Style 7 circuit from the Siemens NCC WAN system to the fire alarm control panel, via the base outside cable plant. The color graphics units (CGU) are located in facility 49750 (Alternate Central Security Building) and a redundant CGU is located in Building 1708 (Hangar R&D). The Siemens programmer must ensure that all information required by the contract drawings and specifications are transmitted and received at both locations, and that all color graphics screens operate properly. Bi-directional communication between the FACP and the NCC WAN must permit individual remote reporting of all monitor zones and remote control of the FACP from both CGU locations.

Fire alarm control panel must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the fire alarm control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

##### 2.1.3.1 Simplex Large Capacity Fire Alarm Control Panel (With Voice)

Unit must be a fully addressable system, Simplex Model 4100U or equal, with 392,000 addressable analog points to include addressable monitoring modules, voice evacuation system, fire fighters phone system, addressable input/output relays and supervised circuits to remote auxiliary control

relays. Construction must be modular with solid-state, microprocessor based electronics. Modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Panel must include all modules required for network communication interface with the existing Simplex Central Fire Monitoring System, including Style 7 module for remote reporting circuits. [Communication interface must permit individual remote reporting of all monitor zones and individual addressable devices, and remote control of the fire alarm control panel outputs from the Central Fire Monitoring System.]

Unit must include all components and modules required for a local facility maintenance and fire fighters phone system. Install a master telephone set at the control panel with remote phone jacks installed in the facility as indicated on the contract drawings.

Unit must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the fire alarm control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

## 2.2 CFMS REPORTING EQUIPMENT

### 2.2.1 Simplex Small Capacity FACP Reporting

\*\*\*\*\*

**NOTE: Edit this paragraph as required for systems  
of 6 reporting zones or less.**

\*\*\*\*\*

Fire alarm control panel must report to the Central Fire Monitoring System using the existing Simplex Model 4100 system located at the [VABR] [LCC 1P11] [CD&SC]. Reporting circuit must be a (2) wire, Style B circuit from the indicated 4100 system zone module to the fire alarm control panel alarm relay and trouble relay via base outside cable plant. A 3.3K ohm, 0.5 watt End-of-Line resistor is required at the FACP.

### 2.2.2 Siemens Small Capacity FACP Reporting

Fire alarm control panel reporting 4 monitor zones or less must report to the Central Fire Monitoring System using the existing Digitize Model 3000 system located in Building XY, which is connected to the Remote Monitor Terminals located in Building 49750 (Alternate Central Security Building) and the redundant unit located in Building 1708 (Hangar R&D).

Reporting circuit must be a 2 wire, Style 6 circuit from Building XY to the fire alarm control panel alarm relay and trouble relay via base outside cable plant. A 15 K ohm, End-of-Line resistor is required at the FACP.

### 2.2.3 Simplex Large Capacity FACP Reporting

\*\*\*\*\*

**NOTE: Edit these paragraphs as required for systems  
installed with Simplex network communications  
interface equipment.**

**Simplex Model GCC Central Fire Monitoring System  
interface equipment are installed in Room 1P11 of  
the Launch Control Center, the VABR, and the CD&SC.**



**Provide network interface cards in the facility FACP  
and at VABR or CD&SC.**

\*\*\*\*\*

Provide network communication from the Simplex 4100U, using a token ring configuration, to the Central Fire Monitoring System existing Simplex equipment located at the VABR and LCC 1P10. Provide non-interfacing reporting for all addressable devices. All addressable devices must be reported to CFMS color graphics units located in the LCC room 1P10. A single open fault on the network communication loop must not degrade network communications. The Token must be passed in opposite directions to maintain communications throughout all network nodes. At the same time the abnormal status condition of the communication loop must be reported to the CFMS. When a group of nodes becomes isolated from the rest of the network caused by multiple open faults, the isolated group must automatically form a sub-network with all common interaction of monitoring and control remaining intact. The status of the network faults must be transmitted to the CFMS. The network communication must be by NFPA 72 Style 7 fiber optic signaling line circuits.

Updated programs, including EPROM, for new or modified fire alarm control systems must be provided and installed in the existing Central Fire Monitoring System by original equipment manufacturer. All EPROM modifications and programming changes to the color graphics units must be approved by the Contracting Officer prior to installation.

#### 2.2.4 Siemens Large Capacity FACP Reporting

\*\*\*\*\*

**NOTE: Edit these paragraphs as required for systems  
installed with Siemens NCC WAN network  
communications interface equipment.**

**Siemens NCC WAN Central Fire Monitoring System  
interface equipment are installed in Room 1P10 of  
the Launch Control Center, the VABR, and the CD&SC.**

**Provide network interface cards in the facility FACP  
and at VABR or CD&SC.**

\*\*\*\*\*

Provide 4 wire copper NFPA 72 Style 7 communication circuit (star) connection between the MXL panel and the Central Fire Monitoring System, existing Siemens NCCNT-WAN communications interface equipment (COM-1) located at [the XY Building] [VABR] [CD&SC]. Provide dedicated house communication cable between the fire alarm control cabinet and the facility telephone terminal cabinet. Communication circuit between the facility and the NCCNT-WAN must be via base outside cable plant. Communication interface must provide remote reporting of all individual addressable devices and remote control of the fire alarm control panel from the CFMS NCC terminal. All addressable devices must be reported to the CFMS NCC color graphics terminals located in the LCC Room 1P10, CSC, and Hangar I. Any single fault, open or short, or combination of a single open or short and a ground fault must not prevent communications over this circuit. The status of these faults must be transmitted to CFMS. A complete failure of this circuit must not degrade network communications.

Updated programs, including EPROM, for new or modified fire alarm control systems must be provided and installed in the existing Central Fire Monitoring System Siemens SXCL multiplexing system or original equipment

manufacturer. All EPROM modifications and programming changes must be approved by the Contracting Officer prior to installation. Install a [96] [192] point terminal strip for interfacing field wiring to the Siemens Model [MXL] and [Fire finder] fire alarm control panel.

#### 2.2.5 Color Graphic Screens for CFMS Reporting System

Updated programs for new or modified fire alarm control systems color graphic screens must be provided and installed in the existing Central Fire Monitoring System [Siemen] [Simplex] multiplexing system by original equipment manufacturer. All modifications and programming changes must be approved by the Contracting Officer, prior to installation.

#### 2.3 ADDRESSABLE MODULES/DEVICES

\*\*\*\*\*  
**NOTE: Select and edit paragraphs as necessary for  
the multiplex system designs only.**  
\*\*\*\*\*

Addressable modules must be solid-state compatible with the Fire Alarm Control panel. Modules must be suitable for individual outlet box mounting or group mounting within a control enclosure. Modules installed outdoors must be installed in weatherproof enclosures with a neoprene gasket and must be protected from corrosion.

Modules must be field addressable to individually communicate with the fire alarm control panel using multiplexed communication techniques. Communication circuit wiring connections must be suitable for supervised Style 6 operation. Module power must be derived from the communication circuit or 24 V(DC) power supply supervised by the fire alarm control panel. Invalid address setting, component failure, or power failure must initiate a trouble signal at the fire alarm control panel.

Paint enclosures with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Enclosures must include an engraved phenolic nameplate labeled, "FIRE ALARM MODULES."

Addressable modules for initiation circuits must be supervised 4-wire Style D type unless otherwise indicated. Addressable modules for notification appliance circuits must be supervised parallel wired Style Z type unless otherwise indicated. Module must be suitable for use with bells, strobes, and relays. Addressable modules for control circuits must include 2 separate fused Form-C contacts rated 2 Amperes at 28 V(DC) or 120 V(AC).

#### 2.4 ANNUNCIATOR PANELS

Annunciator panels must be [LED] [Front lighted] [Back lighted] [LCD alphanumeric] type compatible with and supervised from the fire alarm control panel. Operating power supply must be 24 V(DC). Lamp color must be yellow for trouble and red for alarm; provide a test switch for testing all lamps. Each lamp must have a nameplate with zone and function identified for all lamps. Nameplate must be engraved phenolic tag.

[Annunciator panel must include an audible trouble/alarm buzzer with keyed silence switch.]

Provide LED type graphic annunciator panels where indicated. Annunciator must include laminated area display to indicate location and condition (trouble and alarm) of devices connected.

Provide terminal strips suitable for No. 18 through No. 14 AWG diameter solid copper conductors for all annunciator panel wiring connections.

Mount annunciator panels in manufacturer required enclosures. Where hinged enclosures are used, provide a lock set matching that of the fire alarm control panel. Paint all exposed metal parts of annunciator panels with a prime coat and one or more finish coats of scratch-resistant baked enamel. Finish coat must be red unless otherwise indicated.

## 2.5 HEAT-ACTUATED DETECTORS

Heat-actuated detectors must be alarm-initiating devices designed for use with automatic/manual fire alarm systems in accordance with UL 521.

[Heat-actuated detectors must be rated [58] [88] degrees C [136] [190] degrees F fixed temperature with 15 degree F per minute rate-of-rise feature. Detectors must be self-restorable for the rate-of-rise feature and non-restorable for the fixed temperature feature. Detectors must have a rate-of-rise principle of operation, which uses an air chamber, a vent and a flexible metal diaphragm. The fixed temperature principle of operation must be by a fusible solder joint.]

Detectors must have a set of normally open contacts that close to initiate an alarm. Wiring connections must be suitable for supervised Style D operation, and must be made with terminal blocks capable of accepting No. 18 through No. 14 AWG diameter solid copper conductors. All components of the detectors must be rust and corrosion resistant.

Locate detectors no closer than 12 inches from any part of the lighting fixture and no closer than 24 inches from any supply or return diffuser. Detectors installed in areas subject to moisture or exterior atmospheric conditions must be UL listed or FM approved for such locations.

Locate electronic heat detectors no closer than 1829 millimeter 6 feet from a fluorescent light fixture. Locate detectors no closer than 914 millimeter 3 feet from any return air diffuser and no closer than 1829 millimeter 6 feet from any supply diffuser. Detectors installed in areas subject to moisture or exterior atmospheric conditions must be UL listed or FM approved for such locations.

Enclosures and detectors mounted in hazardous locations must conform to the requirements of Underwriter's Laboratory (UL) or Factory Mutual (FM) for the hazardous location classification indicated. Conduit seal-off fittings suitable for the hazardous location classification must be installed at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

### 2.5.1 Line-Type Fixed Temperature Heat Detector

Provide [thermostatic] or [thermister] line-type heat detection cable [with weather-resistant outer covering] where indicated. Cable must be nominally rated for a temperature of [ 68 degrees C 155 degrees F] [ 88 degrees C 190 degrees F] 138 degrees C 280 degrees F and must operate on fixed temperature principle only.

### 2.5.2 Rate Compensating Heat Detector

Detectors must be hermetically sealed and automatically resetting type

which must operate when ambient air temperature reaches detector setting, regardless of rate of temperature rise. Detector operation must not be subject to thermal lag.

## 2.6 FLAME DETECTORS

\*\*\*\*\*  
**NOTE: Edit paragraphs as necessary for flame  
detection characteristics.**  
\*\*\*\*\*

UV/IR flame detectors must be a unitized device that contains all sensing, signal processing, visual indicators, relay outputs and interfacing components for connection to the fire alarm control panel. The UV/IR detectors must provide both alarm and fault conditions. Alarm conditions must be by sensing both ultraviolet (UV) and flickering infrared (IR) radiation directly correlating to flame intensity. Detector logic must require both UV and IR signals to be present at the proper minimum threshold levels before signaling an alarm condition. The detectors must not be activated by single sources of UV or IR radiation including sunlight (direct, intermittent or reflected), quartz halogen lighting, electric discharge lighting, arc welding, lightning, radiant heat, hot engine exhaust, heating coils, etc. Detectors must also be immune to radio frequency and electromagnetic frequency interference.

Detector must have a minimum field of view of [90] [\_\_\_\_] degrees symmetrical. Detector must be capable of detecting a [1 by 1-foot Class A and B] [\_\_\_\_] fire at [45-feet] [\_\_\_\_] in [five seconds] [\_\_\_\_] typical. Detector response time must be 500 msec typical to initiating fire signal, and extended field adjustable time delay setting must be provided. Detector must include self-diagnostic features to monitor its sensors, power source, and internal circuitry.

Detector must incorporate separate single pole, double throw (SPDT) alarm and trouble contacts rated at 2 Amperes minimum at 30 VDC. The alarm signal processing circuitry must require UV radiation and flickering IR radiation to exceed minimum threshold levels before signaling an alarm condition. The alarm contacts must be field selectable for latching or non-latching operation. Trouble and fault contacts must be non-latching and self-restoring. Detectors must be capable of Style D (Class A) wiring configuration and conductors must be terminated on screw terminals capable of accepting No. 18 through No. 14 AWG diameter solid copper conductors.

Power detectors from a 24 V(DC) source. Where an auxiliary power supply other than the fire alarm control panel is used, the power supply must incorporate a power supply, battery back-up, and power transfer equipment in accordance with the paragraph entitled "Fire Alarm Control Panel". Terminate detector power wiring on screw terminals capable of accepting No. 16 through No. 10 AWG diameter solid copper conductors. Provide 25 percent spare capacity on the power supply circuit for future expansion.

Enclosures and detectors mounted in hazardous locations must conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. Conduit seal-off fittings suitable for the hazardous location classification must be installed at each conduit connection to the explosion-proof enclosure in accordance with **NFPA 70**. Enclosures must be stainless steel, rated NEMA 4X, and must include threaded conduit connection. Mount enclosures on stainless steel swivel base which allows 180-degree horizontal and vertical rotation from the pivot point.

Detector must have an integral built-in test feature, including UV and IR lens testing. Detectors must have self-test capability.

Provide remote optical integrity test capability for each UV/IR detector from the addressable fire alarm control panel. Activate the optical integrity test, manually or automatically, when the addressable control module is activated from the fire alarm control panel. Each control circuit must activate the internal UV and IR test lamps simultaneously for each UV/IR detector connected to the control circuit. Include 25 percent spare capacity on each optical integrity test control circuit. Activation of the control circuit via the control addressable module must cause all the associated UV/IR detectors to go into an alarm condition. When the optical integrity test switch is restored to its normal position all the affected UV/IR detectors must self restore. The addressable device monitoring the UV/IR detector must be a latching type so as to provide alarm identification.

## 2.7 Triple IR Flame Detectors

Triple IR flame detectors must be a unitized detector incorporating all sensory, signal processing, and alarm system interfacing components to provide fire detection by sensing within the CO2 emission band for IR radiation. Detector logic must require IR signal from all three (3) sensors present in the proper spectral signature as emitted by a hydrocarbon fire. The detector must retain alarm-initiating capability in the presence of modulated false alarm sources. Detector must not be activated by single sources of UV and IR radiation including sunlight (direct, intermittent, or reflected), quartz halogen lighting, electric discharge lighting, arc welding, lightning, radiant heat, hot engine exhaust, heating coils, etc. Unit must also be immune from radio frequency interference and electromagnetic frequency interference. Detectors using guard band technology are not acceptable.

Detector must have a minimum field of view of 90 degrees along the horizontal axis and 70 degrees along the vertical axis. Detector must be capable of detecting a 0.3 meter by .3 meter 80 feet gasoline fire at a distance of 64 meters 210 feet on axis, and 46 meters 150 feet off axis. Detect a 0.6 meters by .6 meters 2 foot by 2 foot JP5 pan fire at 30.5 meters 100 feet on axis, and 24.4 meters off axis, as well as an atomized type fire at 15.2 meters 50 feet on and off axis. Detector response time must be selectable to 500 msec with typical response under 5 seconds for initiating fire signal. Detector must include self-diagnostic features to monitor its sensors, power source, and internal circuitry.

Detector must incorporate separate single pole, double throw (SPDT) alarm and trouble contacts rated 5 amperes minimum at 30 V(DC). Alarm contacts must activate upon fire detection and must be programmable for latching or non-latching operation. Cycling detector power or momentarily (10ms) activating the manual test line must reset latching alarm contacts. Trouble contacts must be non-latching and activate upon loss of unit power or internal diagnostic failure. Wiring connections for all contacts must be suitable for Style D wiring and must be made on screw terminals capable of accepting No. 18 through No. 12 AWG solid copper conductors.

Detector must be powered from a 24 V(DC) source. Where a power supply other than the fire alarm control panel is used, the power supply must incorporate power supply, battery backup and power transfer equipment in accordance with the paragraph entitled, "Fire Alarm Control Panel".

Detector power wiring connections must be on screw terminals suitable for No. 16 through No. 10 AWG diameter solid copper conductors. Include 25 percent spare capacity on the power circuit.

Enclosures and detectors mounted in hazardous locations must conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. Install conduit seal-off fittings suitable for the hazardous location classification at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70. Enclosures must be stainless steel, rated NEMA 4X, and must include threaded conduit connection. Mount enclosure on a stainless steel swivel base, which allows 180 degree horizontal and vertical rotation from the pivot point.

Detector must have a calibrated integral optical integrity test feature, including individual test lamps for each IR sensor and generate a fault when 50 percent of the detection range is lost. Detectors must include calibrated self-test capabilities that generate an alarm when more than 50 percent of the detection range is retained.

Provide remote optical integrity test capability for each Triple IR detector from the addressable fire alarm control panel. The optical integrity test must be activated, manually or automatically, when the addressable control module is activated from the fire alarm control panel. Each control circuit must activate the internal IR test lamps simultaneously for each Triple IR detector connected to the control circuit. Include 25 percent spare capacity on each optical integrity test control circuit. Activation of the control circuit via the control addressable module must cause all of the associated Triple IR detectors to go into an alarm condition. When the optical integrity test switch is restored to its normal position all the affected Triple IR detectors must self restore. The addressable device monitoring the Triple IR detector must be a latching type so as to provide alarm identification.

## 2.8 SMOKE DETECTORS

Smoke detectors must be alarm-initiating devices designed for use with automatic/manual fire alarm systems in accordance with UL 268.

Smoke detectors must be [2.5] [\_\_\_\_\_] percent per foot nominal obscuration (photo-electric) type. Detector must be listed for use with fire alarm control panel installed, and must include all required accessories. Detectors and accessories provided must be rust and corrosion resistant. Detector head must be a plug-in unit. Unit must contain no moving parts, nor must it require readjustment or removal to resume normal operation after an alarm. All detector openings must be screened to prevent the entry of insects and debris.

Detector head must plug into a separate receptacle type base. Base must include screw terminals suitable for No. 18 through No. 14 AWG diameter solid copper conductors for all wiring connections required. Base must be supervised to initiate a trouble signal at the fire alarm control panel if the detector is removed. A light emitting diode indicator must provide a visual indication when the detector initiates an alarm.

Locate detectors no closer than 1829 millimeter 6 feet from a fluorescent light fixture. Locate detectors no closer than 914 millimeter 3 feet from any return air diffuser and no closer than 1829 millimeter 6 feet from any supply diffuser. Detectors installed in areas subject to moisture or

exterior atmospheric conditions must be UL listed or FM approved for such locations.

Remote annunciation must be provided in locations readily visible and accessible for detectors installed under raised floors, or other locations where the detector is concealed or not readily visible; or the detector must be of the addressable type. Annunciator panels must be in accordance with paragraph 2.4, "Annunciator Panels." Install remote test/light assemblies for installations that are not readily accessible. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

\*\*\*\*\*  
**NOTE: Use the following paragraph where addressable  
smoke detectors are to be used in lieu of Remote  
Annunciator Panels.**  
\*\*\*\*\*

Provide addressable detector(s) bases where indicated or used in lieu of remote annunciator panels. Addressable detector or base must include circuitry and user selectable switching required for assigning each detector a unique address on the fire alarm control panel communication bus. Invalid address switch settings or component failure must initiate a trouble signal at the fire alarm control panel.

Detectors must be the 2-wire Style D type powered from the panel alarm initiation or communication bus circuit; separate power sources are not acceptable.

\*\*\*\*\*  
**NOTE: Use the following paragraph only where smoke  
detectors are required there is no fire alarm  
control panel available.**  
\*\*\*\*\*

[Separately powered smoke detectors must be suitable for 120 V(AC) operation. Detector must be equipped with a normally open dry contact for alarm operation, and a normally closed dry contact which opens on power failure or trouble within the detector.]

#### 2.8.1 Duct Smoke Detectors

Duct smoke detectors must be alarm-initiating devices designed for use with automatic/manual fire alarm systems in accordance with [UL 268A](#).

Duct smoke detectors must be photoelectric type listed by [UL Fire Prot Dir](#) or FM approval guide for duct smoke detector installation. Duct detectors must be provided with approved duct housings, mounted exterior to the duct, and must be provided with perforated sampling tubes extending across the width of the duct. Activation of duct smoke detectors must cause shutdown of the associated air-handling unit, annunciation at the fire alarm control panel, and transmit a silent alarm to the Central Fire Monitoring Station, but must not activate the building evacuation notification appliances. Duct smoke detectors must be addressable type connected to an addressable FACP with ability to perform sensitivity testing in accordance with [NFPA 72](#). Provide a single maintenance by-pass switch to isolate each air handling units duct smoke detectors. Activation of any maintenance by-pass switch must inhibit reporting and cause a trouble condition at the FACP. When the maintenance by-pass switch is restored to it's normal configuration the

trouble signal at the FACP must be self restoring. Where duct smoke detectors are installed outdoors, in unconditioned mechanical or electrical rooms, or in areas with high ambient temperatures and humidity, or in high ambient temperature areas, install the detector housing in an additional PVC enclosure with an additional set of supply and exhaust sampling tubes to prevent condensation from forming within the detector housing.

Install a separate remote test/light assembly for each duct smoke detector. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

## 2.9 MANUAL ALARM STATIONS

Manual alarm stations must be noncoded, addressable type, alarm-initiating devices designed for use with automatic/manual fire alarm systems in accordance with [UL 38](#).

Wiring terminals must be suitable for 2 wire, Style D wiring and must be capable of accepting No. 18 through No. 14 AWG diameter solid copper conductors.

Manual alarm station door must have a protected, pull-down operating lever with finger grip which does not project out from the front of the case. When operated the station must mechanically latch, break a glass or plastic rod, close one or more sets of contacts, and lock the contacts in the operated position until reset. Stations with a pushbutton which depends upon a spring-loaded device to close the contacts when the handle is pulled are not acceptable. Stations must not be resettable without the use of a key or tool.

Paint all exposed metal surfaces of enclosing cases with a prime coat and one or more finish coats of red enamel to produce a smooth, hard, durable finish. Provide identification and directions for operating fire-alarm stations on the cover in raised or depressed white-enameled letters. Manual alarm stations constructed of plastics or composite material are not acceptable.

Furnish surface-mounted stations with matching cast-iron or cast-aluminum back boxes with top and bottom threaded-conduit connections. Stations mounted outdoors must be weatherproof with a neoprene gasket and must be protected against corrosion. Provide a molded polycarbonate clear protective cover with the provision for a lead seal or plastic supervisory seal in all areas open to the general public. The protective cover must not have an integral warning horn.

Manual pull stations installed in hazardous locations must be UL listed, FM approved, or approved by a recognized testing laboratory for the hazardous location classification indicated. Unit must consist of manufactured explosion-proof manual pull station assembly. Conduit seal-off fittings suitable for the hazard classification must be installed at each conduit connection to the explosion-proof enclosure in accordance with [NFPA 70](#).

## 2.10 ALARM BELLS

Fire-alarm bells must be red, 10 inches vibrating, under-dome, alarm notification appliances in accordance with [UL 464](#). Bell must produce at least 87 dB at 10 feet and must conform to [NFPA 72](#).

Alarm bells must be solenoid-operated plunger sounding devices. Operating



mechanism must be rustproof, protected from dust and insects, and located behind the gong shell.

Alarm bells must operate from polarized 24 V(DC) fire alarm control panel Style Z parallel wired supervised notification appliance circuits. Wiring connection must be on terminal blocks suitable for No. 16 through No. 12 AWG diameter solid copper conductors. Audible notification appliance circuits must have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity per circuit.

Strobe portion of combination audible/visual indicating appliances must be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

Surface-mounted alarm bells installed in unfinished areas with conduit exposed must be secured to surface-mounted back boxes. Back boxes must be cast iron or cast aluminum, with threaded conduit connections. Alarm bells installed outdoors must be weatherproof with a neoprene gasket and must be protected against corrosion. Paint all exposed metal surfaces with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, durable finish.

Alarm bells installed in hazardous locations conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. When the bell is not factory sealed, conduit seal-off fittings suitable for the hazardous location classification indicated must be installed at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70. Explosion-proof bell operating current must not exceed 0.25 amps.

## 2.11 STROBE UNITS

Strobe units must be notification appliances designed for use with automatic/manual fire alarm systems, in accordance with UL 1971

Strobe units must include red cast metal housing, dome polycarbonate white lens with red "FIRE" lettering on two sides, and a xenon flash tube with solid state circuitry. Unit brightness must be 15, 30, 75, or 110 candela in accordance with NFPA 72, producing a minimum flashing frequency of 1 Hz and a maximum of 3 Hz. All strobes must be synchronized and must remain flashing until the fire alarm control panel is reset. Unit must be UL listed or FM approved for their intended use. Visual notification appliance circuits must have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity per circuit.

Unit must operate from polarized 24 V(DC) fire alarm control panel Style Z parallel wired supervised notification appliance circuit. Operating current must not exceed 0.1 amperes, and unit must operate over a 20 percent variation in nominal input voltage. Wiring connection terminal blocks must be suitable for No. 16 through No. 12 AWG diameter solid copper conductors.

Install flush mounted interior units using standard electrical backboxes. Install surface mounted units in cast iron or cast aluminum boxes with threaded conduit hubs. Units mounted in exterior or wet locations must be weatherproof with a neoprene gasket and must be protected from corrosion.

Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard durable finish.

## 2.12 SPEAKERS

Speakers must be notification appliances designed for use with automatic/manual fire alarm systems in accordance with UL 1480 and UL 1711.

Speakers must be UL listed or FM approved for audible signal use, and must be capable of clearly reproducing voice messages and bell tones in a three-pulse temporal pattern over a 400 to 4000 Hz range. Speaker output at 1000 Hz for 1 watt input power must be no less than 87 dB at 3.04 meter 10 feet.

Notification Appliance mechanism must consist of sealed speaker and multiple-tap impedance matching transformer suitable for 25 V(DC) Style Z parallel wired supervised audio signaling systems. Transformer settings must include 0.25, 0.5, 1.0, and 2.0 watt taps unless otherwise indicated. Wiring connections for 4 wire operation must be screw terminals suitable for No. 16 through No. 12 AWG diameter conductors.

Speaker housings must be of red impact resistant polycarbonate or cast metal construction. Mount flush mounted interior speakers using standard electrical back boxes. Mount surface mounted speakers using red cast iron or cast aluminum boxes with threaded conduit hubs. Speakers mounted in exterior or wet locations must be weather-proof with a neoprene gasket and must be protected from corrosion. Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard, durable finish.

Strobe portion of combination audible/visual notification appliance must be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

Speakers mounted in hazardous locations must conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. When the unit is not factory sealed, conduit seal-off fittings suitable for the hazardous location classification indicated must be installed at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

\*\*\*\*\*  
NOTE: Delete this section unless unique  
requirements require the use of revolving beacons.  
Revolving Beacons are used in place of strobes in  
areas identified as hazardous classified locations.  
\*\*\*\*\*

## 2.13 REVOLVING BEACONS

Revolving beacon for use as fire warning light must conform to NFPA 72 and must be capable of accepting 75 watt sealed-beam spot lamps. Each lamp must project its beam downward on a reflector that rotates 360 degrees, 60 times per minute at a 45 degree angle. Lens must be a heat resistant red plastic dome. Unit must be suitable for upright mounting on conduit sized 13 millimeter 1/2 inch minimum. Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, durable finish.

Beacons installed in hazardous locations must be UL listed or FM approved for the hazardous location classification indicated. When the beacon is

not factory sealed, conduit seal-off fittings suitable for the hazardous location classification indicated must be installed at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

#### 2.14 WATER FLOW ALARM DEVICES

Water flow devices must be alarm-initiating devices designed for use with automatic/manual fire alarm systems , in accordance with UL 346.

Water flow alarm devices must conform to UL or FM requirements for the particular type of sprinkler system. Contacts must have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC) .

##### 2.14.1 Pressure Switch

Pressure switch alarm must be wired to make or break an alarm circuit depending on rise or fall of water pressure.

##### 2.14.2 Vane-Type Flow Switch

Vane-type flow alarm must make or break an alarm circuit upon deflection by a volume of flowing water that equals or exceeds the capacity of a single sprinkler. Alarm must have an instant-recycle pneumatic-retard, or electronic adjustable setting time delay.

#### 2.15 VALVE TAMPER SWITCHES

Valve tamper switches must be supervisory initiating devices designed for use with automatic/manual fire alarm systems, in accordance with UL 346.

Valve tamper switches must conform to UL or FM requirements for use on the specified valve. Contacts must have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC) .

Valve tamper switches installed in hazardous locations must be UL listed or FM approved for the hazardous location classification indicated. If the tamper switch is not factory sealed, conduit seal-off fittings suitable for the hazardous location classification indicated and must be installed at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

#### 2.16 REMOTE AUXILIARY CONTROL RELAYS

Remote control relays must have continuous duty coils rated 24 V(DC) . Where relays are used on Style Z parallel wired supervised circuits, coils must incorporate supervisory current blocking diode. Relays must have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC) . Where auxiliary control circuits connected to the relay are protected at a higher ampacity than the relay contacts are rated, fusing rated to protect the relay contacts must be installed in the relay enclosure.

Mount remote auxiliary control relays in enclosures indicated or, if not indicated, in manufacturer's required enclosure. Relays installed outdoors must be installed in a weatherproof enclosure with a neoprene gasket and must be protected against corrosion.

Paint enclosures with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Enclosure must be

labeled with an engraved phenolic nameplate labeled, "F/A RELAY."

Remote auxiliary control relays must be mounted and supervised within <sup>914</sup>millimeter 3 feet of the controlled device in accordance with NFPA 101.

#### 2.17 POWER SOURCE

Normal power to the local systems for all purposes, including separate powered indicating/alarm devices, must be 120 volts 60 hertz. System must operate satisfactorily between 85 and 110 percent of normal voltage. Fire-alarm-system disconnect/protective device must be a fused switch with a red factory finish as specified herein for manual alarm stations. Mount this disconnect switch adjacent to the fire alarm control panel. In addition, it must be marked FIRE-ALARM DISCONNECT with 1/2-inch high letters in white paint or engraved phenolic identification plates fastened with sheetmetal screws. Switch must be capable of being locked in the "on" or "off" position. This feature must not interfere with the circuit protection capability of the device. Switch must be equipped with surge suppression for all phase and neutral conductors. Install current limiting Class RK1 fuses properly sized to protect the fire alarm equipment.

#### 2.18 WIRING

Provide wiring in accordance with NFPA 70 and NFPA 72. Conductors must be copper. Conductors for 120 V(AC) circuits must be No. 12 AWG minimum.

Conductors installed on fire alarm systems must be solid copper with an insulation rating of not less than 300 volts. Conductors must be marked with the size, voltage rating and manufacturer's name permanently marked on the conductor jacket at no less than <sup>610</sup>millimeter 2 feet intervals. Conductor size and color are listed below. Where modifications are made to existing systems, the new or added conductors must match the size and color-coding of the existing system.

Conductors for multiplexed communication circuits, signaling line circuits, speaker audio circuits, remote phone circuits, and remote reporting circuits must be solid copper, shielded, twisted pairs meeting UL 2196. Cable must be listed as Type FPL, Power-Limited Fire Protective Signaling Cable. Conductor size must be not less than No. 16 AWG diameter. Conductor insulation must be Type TFN for No. 16 AWG diameter and Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current initiating device (manual pull station) circuits must be a two loop circuit per NFPA 72, Style D. Conductor size must be not less than No. 16 AWG diameter. Conductor insulation must be Type TFN for No. 16 AWG diameter, and Type THHN/THWN for No. 14 AWG diameter and larger.

Power leads from the control panel for product-of-combustion detectors must be sized accordingly, but not less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current notification appliance circuits (strobes, bells) must be parallel wired per NFPA 72, Style Z. Conductor size must be not less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current auxiliary control device (AHU shut down relay) circuits must be parallel wired per NFPA 72, Style Z. Conductor size must be not less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for

No. 14 AWG diameter and larger.

#### 2.18.1 Fire Resistive Cables

Fire resistive cables must be for notification appliance circuits designed for use with automatic/manual fire alarm systems in accordance with [UL 2196](#)

Provide [UL Fire Prot Dir](#) listed Type FPL-CI fire alarm cable for use with power limited fire alarm notification appliance circuits. The CI cable must have a minimum 2 hour fire resistance rating by having passed the applicable testing requirements of [UL 2196](#). Install this cable in locations required to meet [NFPA 72](#) survivability requirements.

#### 2.19 SURGE SUPPRESSORS

Provide line voltage and low voltage surge suppression devices to suppress all voltage transients which might damage the control panel components.

Install surge suppression in accordance with [UL 497B](#) on each conductor of fire alarm circuits which extend beyond a building. Locate protection as close as practical to the point where the circuits leave the building. Install protectors in surge suppression cabinets of adequate size with terminal strips for all wiring connections plus 25 percent spare. Paint enclosures with a prime coat and one or more coats of red baked enamel finish to provide a smooth, hard, and durable finish. Connect protectors to a earth ground electrode system in accordance with the manufacturer's requirements and [NFPA 70](#). An etched metal or engraved laminated plastic identification plate labeled, "Fire Alarm Cabinet," must be affixed to the cabinet door of the alarm-control unit to identify the cabinet as a fire-alarm cabinet. For cabinets painted red the identification plate must have white letters on a black background. For cabinets not painted red the identification plate must have white letters on a red background.

##### 2.19.1 Line Voltage Surge Suppressors

Suppressor must be [UL 1449](#) listed with a maximum 330 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor must also meet [IEEE C62.41](#) category B tests for surge capacity. Suppressor must be a multi-stage construction which includes inductors and silicon avalanche zener diodes. Suppressor must have a long-life indicating lamp (light emitting diode or neon lamp) which extinguishes upon failure of protection components. Fuses must be externally accessible. Wire in series with the incoming power source to the protected equipment using screw terminations.

##### 2.19.2 Low Voltage Surge Suppressors

Provide for all circuits which leave the building shell and as shown on the contract drawings. When circuits interconnect two (2) or more buildings, provide an arrestor at the circuit entrance to each building. Suppressor must be [UL 497B](#) listed, with a maximum 30 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor must have multi-stage construction and both differential/common mode protection.

## PART 3 EXECUTION

### 3.1 SYSTEM SEQUENCE OF OPERATION

#### 3.1.1 Normal Operation

All switches must be in the normal position. Available power lamp must be on and the trouble and detector identification lamps must be off. All circuits must be electrically supervised.

#### 3.1.2 Supervisory Condition

System conditions identified in the paragraph entitled, "Fire Alarm Control Panel," must transmit a supervisory signal to the Central Fire Monitoring System, provide device indication, activate a supervisory signal in the fire alarm control panel, and provide input to remote annunciators (when used). Supervisory signal in the alarm control unit must be comprised of visual and audible indications. The supervisory signals must be self-restoring.

#### 3.1.3 Trouble Condition

System conditions identified in the paragraph entitled, "Fire Alarm Control Panel," must transmit a trouble signal to the remote reporting device of the Central Fire Monitoring System, provide zone indication, activate a trouble signal in the fire alarm-control panel, and provide input to remote annunciators (when used). Trouble signal in the alarm-control unit must be comprised of visual and audible indications.

#### 3.1.4 Alarm Condition

Activation of any detectors, manual alarm stations, water flow switches, or other initiating devices must close a contact that activates the appropriate fire alarm control panel. Fire alarm control panel transmits a signal to the remote reporting device of the Central Fire Monitor System; activates the facility indicating appliances; provides zone identification; controls air handling and ventilating units; provides an input to remote annunciators (when used); and provides indication or control to devices or other systems.

### 3.2 INSTALLATION

Install all equipment in accordance with manufacturer's recommendations, and this Section.

#### 3.2.1 Fire Alarm Control Panel(s) and Reporting Equipment

Install equipment in each protected building, located where indicated, and complete with all indicated accessories and devices. Install equipment in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of 914 millimeter 3 feet clearance directly in front of the panel for maintenance per NFPA 70. With multiple equipment, the 914 millimeter 3 feet clearance is required directly in front of the complete configuration. In addition, a 711 millimeter 28 inch clear aisle way must be provided for access to the equipment.

Wiring within fire alarm control panel(s) and reporting equipment must be in accordance with the paragraph entitled, "Installation in Cabinets and

Boxes."

Conductors in accordance with the paragraph entitled, "Wiring," must be installed from the [modem cabinet] [code transmitter] [fire alarm control panel] to a new [4] [8] point terminal strip labeled "FATB" in the indicated telephone terminal cabinet.

When fire alarm control panels and reporting equipment are installed flush or semi-flush, three spare 25 millimeter 1-inch conduits in accordance with the paragraph entitled, "Conduit and Raceways," must be installed from the fire alarm control panel wiring termination cabinet to an accessible location.

### 3.2.2 Addressable Modules and/or Devices

Install zone addressable modules at accessible locations indicated. Configure module address switches to settings indicated on approved shop submittals. Modules must be identified individually adjacent to their mounting.

Mount control zone addressable modules used for smoke control, AHU shutdown, etc. in accessible locations within 914 millimeter 3 feet of the device to be controlled. Control modules connected to separately energized control wiring from auxiliary systems must not be installed in the same enclosure with initiation and signal zone addressable modules.

Where zone addressable modules are grouped within an enclosure, wiring must be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes."

### 3.2.3 Annunciator Panels

Install panels in accessible locations in such a manner as to prevent damage from vibration or jarring.

Install annunciator panels in each protected building, located where indicated, complete with all indicated accessories and devices. Install annunciator panels in accessible locations in such a manner as to prevent damage from vibration or jarring. Annunciator panels require a minimum of 914 millimeter 3 feet clearance directly in front of the panel for maintenance, per NFPA 70. With multiple panels, the 914 millimeter 3 feet clearance is required directly in front of the complete configuration. In addition, provide a 711 millimeter 28 inch clear aisle way for access to the annunciator panels.

Wiring within annunciator panels must be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes."

### 3.2.4 Heat-Actuated Detectors

Ceiling-mount detectors unless otherwise indicated. Location, number, and general arrangement to be as indicated. Field installation locations must comply with NFPA 72.

### 3.2.5 Flame Detectors

Flame detector location and general arrangement must be as indicated. Adjust location as required to prevent obstruction of the detector field of view, and provide coverage in all protected areas by at least one detector.

Where detectors are installed outdoors, arrange conduit systems to drain away from the detector. Aim detectors to accurately cover the field specified.

#### 3.2.6 Smoke Detectors

Smoke detector location, number, and general arrangement must be as indicated; field installation must be in accordance with NFPA 72. Detectors must not be installed until the work of other trades is complete.

Install duct smoke detectors in accordance with the manufacturer's requirements and NFPA 90A. Seal all duct penetrations air and water-tight.

Configure addressable smoke detector address switch settings as approved on shop drawings and submittals. Detectors must not be installed until work by other trades is completed.

#### 3.2.7 Manual Alarm Stations

Mount manual pull stations at locations indicated within 457 millimeter 18-inches of the latch side of the door. Mounting height must be 1219 millimeter 48-inches above the finished floor measured from the top of the device.

Where manual pull stations are installed outdoors, arrange conduit systems to drain away from the manual pull stations.

#### 3.2.8 Alarm Bells/Speakers

Mount bells and/or audio speaker notification appliances at the approximate locations indicated. Mounting height must be 2286 millimeter 90-inches above the finished floor measured from the top of the bell/speaker, but no less than 152 millimeter 6-inches below the ceiling.

Where bells or speakers are installed outdoors, arrange conduit systems to drain away from the bells or speakers.

#### 3.2.9 Strobe Units/Combination Audio Visual

Mount strobe notification appliances at the approximate locations indicated. Locations must be unobstructed and allow viewing by area occupants in accordance with NFPA 70. Mounting height must be 2032 millimeter 80-inches above the finished floor measured from the bottom of the strobe, but no less than 152 millimeter 6-inches below the ceiling.

Where strobes are installed outdoors, arrange conduit systems to drain away from strobes.

#### 3.2.10 Auxiliary Control Relays

Remote control relays must be installed and supervised in accessible locations within 914 millimeter 3 feet of the device to be controlled.

#### 3.2.11 Wiring

Wiring must conform to the requirements of NFPA 70 and the following special requirements:



Install fire alarm system circuits in a separate raceway system. Route each circuit type (Initiating, Notification, Signaling, and Control) through a dedicated separate conduit or raceway system configured to comply with NFPA 72 Class "A" conduit system requirements. 60-Hertz power circuits must not enter enclosures containing fire alarm circuits except where required to connect to the fire alarm system.

Conductors must be continuous from a terminal point at one device to a terminal point at the next device and from a device to the fire alarm (control) panel. Break wires at each terminal; wires must not be looped over a terminal. Approved explosion proof devices provided with pigtail wiring connection leads must be terminated on a field installed terminal strip installed in the box on which the device is mounted. Install solderless ring tongue terminal lugs with manufacturer's required tooling on the device wiring connection leads. This ring type lug is to be used on stranded wire only. Termination of solid wire must be made on compression or screw type terminals. When screw type terminals are used the conductor must be captured under 80 percent of the screw head surface.

Conductor colors are listed below and must be in accordance with FED-STD-595. Where modifications are made to existing systems, the new or added conductors must match the size and color-coding of the existing system.

Conductors for multiplexed communication circuits, speaker audio circuits, remote phone circuits, and remote station signaling circuits must be marked with circuit designation, and consistent color-coding for the positive and negative loops must be maintained throughout the cable system.

Direct current initiating device circuits (heat detectors, manual pull station) must be a two loop circuit per NFPA 72, Style D with the positive loop conductor colored blue, Color No. 15102, and the negative loop conductor colored black, Color No. 17038.

Power leads from the control panel for product-of-combustion detectors must be one white, Color No. 17877 positive and one black, Color No. 17038 negative.

Direct current notification appliance circuits (bells, strobes) must be parallel wired per NFPA 72, Style Z. Positive conductor must be colored red, Color No. 11105 and the negative conductor must be colored orange, Color No. 12473.

Direct current auxiliary device control device circuits (AHU shutdown relay) must be parallel wired per NFPA 72, Style Z. Positive conductor must be colored yellow, Color No. 13591 and the negative conductor must be colored brown, Color No. 10055.

#### 3.2.11.1 60-Hertz Power

60-hertz power to fire alarm control panels or separately powered devices must be 120 volts. There must be one black phase conductor, one white or gray solidly grounded neutral conductor and one green equipment grounding conductor. Conductor size must be as shown on the drawing with the minimum size No. 12 AWG copper. Install surge arrestors in accordance with NFPA 72 and NFPA 70.

### 3.2.11.2 Installation in Cabinets and Boxes

Install wiring in control cabinets and boxes in a neat and orderly manner with wire properly grouped, tie-wrapped, or laced parallel and perpendicular to the major axis, supported and identified. Control wiring must be continuous from device to device with no splices unless otherwise indicated. All wires entering or leaving control cabinets, boxes, and devices must be permanently marked and terminated on screw terminals. Marking must be consistent throughout the fire alarm system and must be the same as the identification shown on the connection drawings.

### 3.2.12 Conduit and Raceways

Minimum size for fire alarm system initiating, notification, signaling line and control circuit conduits and raceways must be 12 millimeter 3/4-inch. Installation must be in accordance with NFPA 70.

Install rigid galvanized steel conduit in all hazardous (classified) locations, exterior locations where the conduit is exposed above grade, interior exposed locations from finished floor to 304 millimeter 1 foot above finished ceiling unless otherwise shown on the drawings. EMT with hexnut expansion gland-type fittings can be installed in all other locations. Use flexible metal conduit, maximum length 1828 millimeter 6 feet, as the final connecting raceway to a fire alarm device mounted on vibrating equipment or on a suspended ceiling.

Conduit direct buried in earth must be schedule 80 PVC. Portions of underground raceway system that penetrate above finished grade must be rigid galvanized heavywall steel conduit with a 40-mil PVC coating or painted with a bitumastic compound.

Conduit in interior finished areas must be concealed. Conduit through fire-resistant rated walls, floors, ceilings, must be fire-stopped in a manner that maintains the fire-resistant rating of the wall, floor or ceiling.

Conduit installed in a vertical position must be parallel with walls and perpendicular with the floor and ceiling. Conduit installed in a horizontal position must be parallel with the floor and ceiling and be perpendicular with the walls. Changes in direction of runs must be made with symmetrical bends. Bends of over 25 millimeter one inch in diameter must be factory made elbows.

### 3.2.13 Elevators

Initiating devices to effect control of the elevator(s) in an alarm condition must report through the facility fire alarm system which must initiate the following actions in the elevator controls in accordance with ASME A17.1 and NFPA 72:

- a. Primary Fire Fighter Recall
- b. Secondary Fire Fighter Recall
- c. Power Feed Shunt-Trip
- d. "Do Not Use Elevator" Warning.

### 3.3 FIELD TESTING

After complete installation of the equipment and at such time as directed by the Contracting Officer, conduct tests to demonstrate that the

installation requirements of this specification have been met and that the sequential functions of the system comply with the requirements specified herein. Tests covered in the following paragraphs must be done in two parts:

- a. Preliminary - This must be an "in house" test to verify all the systems and components. Perform this functional test in the presence of government inspectors and repeat until performing one full test without device or system malfunction.
- b. Final Acceptance - After the successful completion of the preliminary testing, the systems must be fully tested formally with full documentation (including As-Built Drawings) using the previously approved recording form. Contracting Officer must witness this test and final acceptance of the system is based upon his written approval of the test.

On both preliminary and final tests, follow the approved testing procedures.

#### 3.3.1 External System Wiring

Perform the following tests on the external system wiring before connection to the control panel:

Check continuity of circuits with an ohmmeter. Insert temporary jumpers in appropriate sockets of missing detectors and install the end-of line resistor when this test is performed. Resistance reading for each circuit must be the value of the end-of-line resistor, plus or minus 10 percent.

Each wire must be checked for grounds with a 500-volt insulation resistance test set. Resistance to ground must not be less than 20 megohms.

#### 3.3.2 Fire Alarm System Acceptance Tests

After completion of the above tests, connect the external system wires to the appropriate terminals in the control panel and perform the following tests:

With the control panel energized, demonstrate the proper operation of all indicating lights and alarms.

Demonstrate each annunciator panel lamp to operate when its associated device or zone is activated.

Activate each manual alarm station to demonstrate proper operation.

Each duct smoke detector must have a static pressure differential test performed to verify the pressure differential between the inlet and outlet tubes is within the manufacturer's specifications for acceptable operation.

Activate each flame detector in accordance with the manufacturers recommendation; verify both alarm and trouble indications at the fire alarm control panel.

Activate each optical integrity test switch and verify that each flame detector on this circuit went into alarm and that the addressable

interface modules latched in the alarm condition. Restore the test switch and visually verify the flame detectors returned to normal operation.

Each time an initiating or supervisory circuit is activated, verify that the associated device address, notification appliances circuits, auxiliary control circuits, and alarm reporting to the Central Fire Monitoring System is activated and the correct information is displayed by the color graphics units.

Remove and ground one lead at each alarm initiating device, (manual pull station, smoke detector, flame detector, heat actuated detector etc.), to demonstrate circuit trouble, ground fault, and then alarm over ground fault with an open circuit.

Turn off power to each separately powered panel or device to simulate loss of power and to demonstrate operation of the trouble alarm.

Test the rate-of-rise function on each heat-actuated detector in each zone by application of heat from a heat lamp or hand held hot air blower. These detectors must initiate an alarm to the system. Detectors must sustain repeated tests of the rate-of-rise function without damage to the fixed temperature function. Replace heat-actuated detectors (HADS) subject to operation from body temperature.

Open and close water suppression system valves requiring tamper switches, to demonstrate proper operation.

Activate water flow/pressure switches by water flow at the inspectors test valve to demonstrate proper operation. Set water flow time delay between 45 and 90 seconds.

Demonstrate each alarm initiating circuit to operate its associated alarm-control and auxiliary control units and remote reporting.

Remove and ground one lead at each notification appliance and auxiliary control device to demonstrate open circuit trouble, ground fault trouble, and then operation over ground fault with an open circuit.

Demonstrate each alarm control unit to operate in all modes.

Demonstrate capacity and the operation of the battery backup system to operate as required by these specifications by disconnecting the 120 volt, 60 Hz power from the fire alarm (control) panel and operating the system as specified for backup operation.

Demonstrate all circuits interconnecting with other systems fire protection, smoke control, HVAC, security and safety, elevators, etc., to operate as specified on alarm from the associated zone or zones.

Test multiplex equipment, devices, and wiring in accordance with NFPA 70 and manufacturer's requirements.

### 3.3.3 Reacceptance System Tests

Perform reacceptance testing after system components are added or deleted; after any modification, repair, or adjustment to system hardware or wiring; or after any change to software. All components, circuits, systems

operations, or site specific software functions known to be affected by the change or identified by a means that indicates the system operational changes must be 100 percent tested. In addition, also test 10 percent of the initiating devices that are not directly affected by the change and verify proper system operation.

Changes to all control units connected or controlled by the system executive software require a 10 percent functional test of the system, including a test of at least one device on each input and output circuit to verify proper system operation.

Upon completion of the modification, functionally test the existing devices that were reinstalled and test the devices that are on both sides of the point of connection of the new devices. All newly installed devices must be tested in accordance with the paragraph entitle, "Fire Alarm System Acceptance Tests."

After final acceptance testing has been successfully completed, submit test data under the terms of the "GENERAL REQUIREMENTS" clause of this contract.

#### 3.4 OPERATION AND MAINTENANCE MANUALS

Submit Operation and Maintenance Manuals. Information bound in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions. Submit this information prior to acceptance tests being performed.

#### 3.5 PAINTING

Manufacturer's standard finish equipment surfaces damaged during construction must be brought to as-new condition by touchup or repainting to the satisfaction of the Contracting Officer, or replaced with new undamaged equipment at no additional cost to the Government.

Paint all fire alarm equipment and appurtenances red, Color No. 11105 in accordance with [FED-STD-595](#).

-- End of Section --